CLAIMS

What is claimed is:

1. A hybrid Multi-User Detector for processing a plurality of received signals, comprising:

    a parameter estimation unit coupled to said received signals;

    a high complexity multi-user detector coupled to said parameter estimation unit, wherein said high complexity multi-user detector performs a pruned tree search and outputs a plurality of information streams, one stream corresponding to each of said received signals;

    a bank of high complexity decoders coupled to said plurality of information streams, wherein said high complexity decoders output a plurality of refined information streams;

    a low complexity multi-user detector coupled to said bank of high complexity decoders, said plurality of refined information streams, and said parameter estimation unit, wherein said low complexity multi-user detector outputs a plurality of improved information streams; and

    a bank of error correction decoders coupled to said plurality of improved information streams, wherein said error correction decoders output a plurality of refined-improved information streams, said plurality of refined-improved information streams fed back to said low complexity multi-user detector until a final condition is reached and said bank of error correction decoders output a final plurality of symbol streams.

2. The hybrid Multi-User Detector according to Claim 1, wherein said high complexity multi-user detector uses algorithms selected from the group comprising: M-algorithm, T-algorithm, FANO, and reduced state Viterbi.

3. The hybrid Multi-User Detector according to Claim 1, wherein said error correction

2   decoders are selected from the group comprising: maximum a posteriori (MAP)

3   decoders, and soft-output Viterbi algorithm (SOVA) decoders.

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1   4.   The hybrid Multi-User Detector according to Claim 1, wherein said high

2   complexity multi-user detector is a soft decision output (SO) multi-user detector

3   that uses an algorithm selected from the group comprising: MT-algorithm, based

4   upon MAP, Log-MAP, and Max-Log MAP detectors.

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1   5.   The hybrid Multi-User Detector according to Claim 1, further comprising an

2   interleaver coupled between said high complexity multi-user detector and said bank

3   of high complexity decoders, a deinterleaver coupled between said bank of high

4   complexity decoders and said low complexity multi-user detector, an interleaver

5   coupled between said low complexity multi-user detector and said bank of error

6   correction decoders and a deinterleaver coupled between said bank of error

7   correction decoders and said low complexity multi-user detector.

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1   6.   The hybrid Multi-User Detector according to Claim 1, wherein said final stopping

2   point is a fixed number of iterations.

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1   7.   The hybrid Multi-User Detector according to Claim 1, wherein said final stopping

2   point is determined by an allowable performance level.

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1   8.   The hybrid Multi-User Detector according to Claim 1, further comprising a filter

2   unit coupled to said received signals, wherein said filter unit is coupled to the said

3   received signal, the said parameter estimation unit, and said high complexity multi-

4   user detector.

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1   9.   The hybrid Multi-User Detector according to Claim 8, wherein said filter unit is

2   selected from the group comprising: whitening matched filter bank, and matched

3   filter bank.

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1 10. The hybrid Multi-User Detector according to Claim 1, further comprising a hard
2   decision unit coupled to said low complexity bank of decoders and producing said
3   final data stream.
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1 11. A hybrid receiver for processing a plurality of received signals in a super-saturated
2   condition, said receiver comprising:
3   a parameter estimation unit coupled to said received signals, wherein said
4   parameter estimation unit extracts received signal information;
5   a front end section coupled to said received signals and to said received
6   signal information to produce a plurality of filtered received signals;
7   a high complexity multi-user detector coupled to said filtered received
8   signals, wherein said high complexity multi-user detector performs a pruned
9   tree search and outputs a plurality of information streams, one stream
10   corresponding to each of said filtered received signals;
11   a bank of high complexity decoders coupled to said plurality of information
12   streams, wherein said high complexity decoders output a plurality of refined
13   information streams;
14   a low complexity multi-user detector coupled to said plurality of refined
15   information streams, and said received signal information, wherein said low
16   complexity multi-user detector outputs a plurality of improved information
17   streams; and
18   a bank of low complexity decoders coupled to said plurality of improved
19   information streams, wherein said low complexity decoders output a
20   plurality of refined-improved information streams, said plurality of refined-
21   improved information streams fed back to said low complexity multi-user
22   detector until a final condition is reached and said bank of error correction
23   decoders output a final plurality of symbol streams.
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1 12. The hybrid receiver according to Claim 11, wherein said high complexity multi-
2   user detector uses algorithms selected from the group comprising: M-algorithm, T-
3   algorithm, FANO, and reduced state Viterbi.

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13. The hybrid receiver according to Claim 11, wherein said low complexity decoders
2   are selected from the group comprising: maximum a posteriori (MAP) decoders
3   and soft-output Viterbi algorithm (SOVA) decoders.
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14. The hybrid receiver according to Claim 11, wherein said low complexity multi-user
1   detector is a soft decision input soft decision output (SISO) multi-user detector that
2   uses an algorithm selected from the group comprising: MT-algorithm, MAP, Log-
3   MAP, or Max-Log MAP detectors.
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15. The hybrid receiver according to Claim 11, further comprising an interleaver
1   coupled between said high complexity multi-user detector and said bank of high
2   complexity decoders, a deinterleaver coupled between said bank of high
3   complexity decoders and said low complexity multi-user detector, an interleaver
4   coupled between said low complexity multi-user detector and said bank of low
5   complexity decoders and a deinterleaver coupled between said bank of low
6   complexity decoders and said low complexity multi-user detector.
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16. The hybrid receiver according to Claim 11, wherein said final stopping point is a
1   fixed number of iterations.
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17. The hybrid receiver according to Claim 11, wherein said final stopping point is
1   determined by an allowable performance level.
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18. The hybrid receiver according to Claim 11, wherein said front end comprises a
1   filter unit.
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19. The hybrid receiver according to Claim 18, wherein said filter unit is selected from
1   the group comprising: whitening matched filter, and matched filter.
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20. The hybrid receiver apparatus according to Claim 11, wherein said front end
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2   comprises a matched filter, an overloaded asynchronous whitener, and a symbol-
3   hypothesis testing section.

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1   21.   The hybrid receiver according to Claim 11, further comprising a hard decision unit
2   coupled to said low complexity bank of decoders and producing said final data
3   stream.

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1   22.   A method for processing signals from multiple users providing raw digitized data,
2   comprising:
3   performing parameter estimation of said raw digitized data;
4   computing decision tree searching path metrics from said raw digitized data
5   using a high complexity multi-user detector in the first iteration and
6   outputting one symbol stream for each user;
7   decoding one symbol stream for each user from said high complexity multi-
8   user detector and producing a higher quality symbol stream for each user;
9   incorporating the information from said higher quality symbol stream into a
10   low complexity multi-user detector and providing an improved version of
11   the symbol streams, one for each user;
12   decoding said symbol streams output by the low complexity MUD;
13   repeating said steps of incorporating information from said improved
14   symbol stream into the low complexity MUD and decoding of each symbol
15   stream output by the low complexity MUD until a final state is obtained;
16   and,
17   outputting a final symbol stream for each user.

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1   23.   The method for processing receiver signals according to claim 22, wherein said
2   final state is determined by a fixed number of iterations.

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1   24.   The method for processing receiver signals according to claim 22, wherein said
2   final state is determined by establishing an allowable difference in symbol values
3   from said last iteration.

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1   25.   The method for processing receiver signals according to claim 22, further
2   comprising de-interleaving and interleaving.

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1   26.   The method for processing receiver signals according to claim 22, further
2   comprising filtering of said raw digitized data.